Decision Rationale

Total Maximum Daily Load for
The Aquatic Life Use Impairment on
Mill Creek

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water-quality limited water body.

This document will set forth the U. S. Environmental Protection Agency's (EPA) rationale for approving the TMDL for the aquatic life use impairment on Mill Creek. EPA's rationale is based on the determination that the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations (WLAs) and load allocations (LAs).
3) The TMDL considers the impacts of background pollutant contributions.
4) The TMDL considers critical environmental conditions.
5) The TMDL considers seasonal environmental variations.
6) The TMDL includes a MOS.
7) There is reasonable assurance that the TMDL can be met.
8) The TMDL has been subject to public participation.

II. Background

The Mill Creek Watershed is located in Shenandoah County, Virginia. Mill Creek is a tributary to the North Fork of the Shenandoah River. The benthic impairment on Mill Creek extends 7.6 miles from Mill Creek's confluence with Straight Run to its mouth. The 12,000-acre watershed is rural with forested and agricultural lands making up 97 percent of the watershed. The remainder of the watershed is composed of developed lands.

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality listed Mill Creek (VAV-B48R) on Virginia's 1998 Section 303(d) list as being unable to attain the general standard due to an aquatic life use impairment identified through benthic assessments. This decision rationale will address the TMDL for the aquatic life use

impairments.

To assess the biological integrity of a stream, Virginia uses EPA's Rapid Bioassessment Protocol II (RBPII) to determine the status of a stream's benthic macroinvertebrate community.[1] This approach evaluates the benthic macroinvertebrate community between a monitoring site and its reference station. Measurements of the benthic community, called metrics, are used to identify differences between monitored and reference stations.[2] The state is currently in the process of changing this methodology to a stream condition index (SCI) approach.

As part of the RBPII approach, reference stations are established on streams which are minimally impacted by humans and have a healthy benthic community. These reference stations represent the desired community for the monitored sites. Monitored sites are evaluated as non-impaired, slightly impaired, moderately impaired, or severely impaired based on a comparison of the biological community of the reference and monitored sites. Streams that are classified as moderately (after a confirmatory assessment) or severely impaired after an RBPII evaluation are classified as impaired and are placed on the Section 303(d) list of impaired waters. Mill Creek was first assessed as moderately impaired at station MIL002.20 in the spring of 1996. The assessments at this monitoring station have bounced between non-impaired, slightly impaired and moderately impaired based on the reference site from 1995 through 2005. As part of the TMDL process, benthic assessments were conducted upstream of the listed segment on Mill Creek. The two upstream stations on Mill Creek were sampled in the spring of 2006 and found to be non-impaired. An assessment was also conducted on Crooked Run a tributary to Mill Creek located upstream of station MIL002.20 and downstream of the two non-impaired stations. The assessment found that Crooked Run contained a moderately impacted benthic community.

The SCI method was used to evaluate the data collected from station MIL002.20 as well. The proposed impairment threshold for the SCI is 61.3. Two of the last four assessments were evaluated as non-impaired using the SCI. The other two assessments were just slightly below the impairment threshold. Based on this data the impairment on this stream appears to be minor. The benthic community on Crooked Run was assessed as impaired and it appears as though this tributary is impacting the benthic community on Mill Creek downstream of its confluence.

The RBPII analysis assesses the health of the macroinvertebrate community of a stream. The analysis will inform the biologist if the stream's benthic community is impaired. However, it will not inform the biologist as to what is necessarily causing the degradation of the benthic community. Additional analysis may be required to determine the pollutants which are causing the impairment as information can be gleaned based on the composition of the community and the condition of the habitat. TMDL development requires the identification of impairment

[1]Tetra Tech 2002. Total Maximum Daily Load (TMDL) Development for Blacks Run and Cooks Creek. Fairfax, Virginia.

[2]Ibid 1

causes and the establishment of numeric endpoints that will allow for the attainment of designated uses and water quality criteria.[3]

A stressor identification study was conducted to determine what was impacting the benthic community on Mill Creek and Crooked Run. Although, Crooked Run is not listed on the Section 303(d) List, the spring 2005 sampling indicates an impairment does exist and TMDL actions are needed. Possible stressors were evaluated against Virginia's applicable numeric water quality criteria. Evaluated pollutants were determined to be non-stressors, possible stressors or most probable stressor. The impairment on Mill Creek is minimal based on the benthic evaluations therefore there is not a clearly defined stressor. Sediment was determined to be the most probable stressor based on the habitat assessment scores for embeddedness on Crooked Run, poor riparian vegetative cover in Mill Creek and channel streambank degradation.

A numeric water quality criterion does not exist for sediment. Therefore, a reference watershed approach was used to determine the numeric endpoint for the sediment load to Mill Creek. Numeric endpoints represent the water-quality goals that are to be achieved through the implementation of the aquatic life use TMDL which will allow the impaired water to attain its designated use. A reference watershed approach is based on selecting a non-impaired watershed that shares similar land use, ecoregion, and geomorphological characteristics with the impaired watershed. The stream conditions and loadings in the reference stream are assumed to be the conditions needed for the impaired stream to attain standards. Upper Mill Creek (above the Crooked Run confluence) was used as the reference watershed for Mill Creek.

The benthic TMDL was developed using the Generalized Watershed Loading Function model (GWLF). The GWLF model provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land).[4] GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[5] Calculations are made for sediment based on daily water balance totals that are summed to give monthly values.

Table 1 - Summarizes the Specific Elements of the TMDL.

Segment	Parameter	TMDL	WLA	LA	MOS
Mill Creek	Sediment (tons/yr)	2,522	0.9	2,269	252

The United States Fish and Wildlife Service has been provided with a copy of the

[3]Ibid 1

[4]Ibid 1

[5]Ibid 1

TMDL.

III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing an aquatic life (benthic) use impairment TMDL for Mill Creek. EPA is therefore approving the TMDL. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to meet the applicable water quality standards.

As stated above, the biological assessments on Mill Creek were not able to discern a clear stressor to the Creek. The TMDL modelers therefore conducted a stressor identification analysis to determine what was impacting the benthic community. Ambient water quality data was able to rule out temperature or pH as possible stressors to Mill Creek. An excessive loading of sediment was seen as the cause of the benthic impairment on Mill Creek. This determination was based on the results of the habitat assessment on Crooked Run and the condition of the banks of Mill Creek. In high enough concentrations, sediment can have detrimental impacts on the benthic community. Sediment fills interstitial spaces that provide habitat for many organisms. Excessive levels of sediment may also clog an organisms gill surfaces thus lowering its respiratory ability. Lastly, excessive sediment increases turbidity which lowers the feeding efficiency of visual predators.

The GWLF model was used to determine the loading rates of sediment to the impaired and reference stream from all point and nonpoint sources. The TMDL modelers determined the sediment loading rates within each watershed. Data used in the model was obtained on a wide array of items, including land uses in the area, point sources in the watershed, weather, stream geometry, etc.

The GWLF model provides the ability to simulate runoff and sediment loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land). GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[6] Local rainfall and temperature data were needed to simulate the hydrology, this data was obtained from the National Climatic Data Center station 442663. In the GWLF model, the nonpoint source load calculation is affected by terrain conditions, such as the amount of vegetative, land slope, soil erodibility, and land practices used in the area.[7] Parameters within the model account for these conditions and practices. A stream channel erosion model was added to GWLF to account for this source of sediment. The GWLF model was developed to simulate hydrology in ungaged watersheds. The Hydrology model was not calibrated but the model parameters that were used were evaluated to insure they were reasonable.

[6]Ibid 1

[7]Ibid 1

The appropriate sediment loading to Mill Creek was determined based on the simulated sediment load to Upper Mill Creek. Since Upper Mill Creek is the non-impaired portion of the watershed, it was assumed that the sediment loading to this portion of the watershed would allow the lower portion of the watershed to contain a non-impaired benthic community. Based on the most recent water quality data, it appears as though the biological impairment on Mill Creek is limited and the problems might be associated with the sediment loading of Crooked Run.

2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

Virginia indicates that the total allowable loading is the sum of the loads allocated to land-based precipitation-driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of sediment to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual basis.

Waste Load Allocations

There are nine active permits for sediment in the Mill Creek watershed at this time. Eight of the nine facilities are controlled under a general permit for home waste disposal. These single family units, discharge 1,000 gallons of effluent per day or less with an allowable total suspended sediment concentration of 30 milligrams per liter. The remaining facility is for an industrial stormwater permit that enables the facility to discharge stormwater with a TSS concentration of 60 milligrams per liter. Table 2 documents the WLA for each of these facilities.

EPA regulations require that an approvable TMDL include individual WLAs for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), "Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7." Furthermore, EPA has authority to object to the issuance of any National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with the WLAs established for that point source.

Table #2 – TMDL WLAs for Sediment

Facility	Permit Number	WLA
Hepner Blocks	VAR050943	0.6 (tons/yr)
Eight Single Family Units	VAG401675, VAG401399, VAG401547, VAG408055, VAG401350, VAG401703, VAG401036, VAG401666	0.33 (tons/yr)

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished. The GWLF model was used to ascertain the sediment loading to Mill Creek and Upper Mill Creek the reference watershed. The model provides the monthly sediment load to the stream through the use of the universal soil loss equation (USLE). The USLE derives the sediment loading by using information on precipitation rates, best management practices, land slope, and vegetative cover. Table 3 identifies the current and TMDL loading for sediment to Mill Creek.

Table 3 – TMDL LAs for Sediment

Source Category	Existing Load (tons/yr)	Proposed Load (tons/yr)	Percent Reduction
Agriculture	6,273	1,678	73
Forest	403	403	0
Developed	629	168	73
Channel Erosion	71	19	73

3) The TMDL considers the impacts of background pollution.

The TMDL considers the impact of background pollutants by considering the sediment loadings from background sources such as forested land.

4) The TMDL considers critical environmental conditions.

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water-quality of Mill Creek is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards[8]. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a

[8]EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

The GWLF model was run over a multi-year period to insure that it accounted for a wide range of climatic conditions. The allocations developed in these TMDL will therefore insure that the criterion is attained over a wide range of environmental conditions including wet and dry weather conditions.

5) The TMDL considers seasonal environmental variations.

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods. Consistent with the discussion regarding critical conditions, the GWLF model and TMDL analysis effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time and by modifying waste application rates, crop cycles, and livestock practices.

6) The TMDL includes a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. An explicit 10 percent MOS was used for the sediment TMDL.

7) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

8) The TMDL has been subject to public participation.

During the development of the TMDL for the Mill Creek Watershed, public meetings were held to discuss and disseminate the TMDL. A basic description of the TMDL process and the agencies involved was presented at the first public meeting on May 18, 2005 at the St.

Andrew's Episcopal Church in Mount Jackson, Virginia with 20 people in attendance. The second public meeting was held on March 21, 2006 at the Shenandoah County Parks and Recreation Office in Edinburgh, VA with 40 people in attendance. Both meetings were open to a 30-day public comment period.